

CLAIMS:

1. A method of operating a circuit board stuffing production plant comprising:

(a) in the board stuffing plant, mounting bottom units each including one or more chips to circuit boards by connecting board connections on bottom sides of said units with the circuit boards, said units and having top connections on top sides;

(b) procuring packaged chips; and

(c) mounting said packaged chips to said top connections of said units in the board stuffing plant.

2. A method as claimed in claim 1 wherein said step of procuring packaged chips includes procuring packaged chips of the same functionality from a plurality of sources.

3. A method as claimed in claim 1 wherein said top connections include top contacts overlying the one or more chips of each said bottom chip unit, and wherein said step of mounting said packaged chips includes connecting the packaged chips to the top contacts overlying the chips of the bottom units.

4. A method as claimed in claim 1 wherein said packaged chips are standard packaged chips.

5. A method as claimed in claim 1 wherein said step of mounting said bottom units to the circuit boards is performed while the top connections of the bottom units are unfilled, and wherein said step of mounting the packaged chips to the top connections of said bottom units is performed after said step of mounting said bottom units to circuit boards.

6. A method as claimed in claim 5 wherein said step of mounting said packaged chips to said top connectors is performed using the same production line as said step of mounting said bottom units to said circuit boards.

7. A method as claimed in claim 1 further comprising the step of procuring said bottom units from one or more sources external to the board stuffing plant.

8. A method as claimed in claim 1 further comprising the step of fabricating said bottom units in said board stuffing plant.

9. A semi-finished circuit board assembly comprising:

(a) a circuit board having a top surface and contact pads exposed at said top surface;

(b) a bottom unit including at least one bottom unit chip, said bottom unit having mounting connections facing downwardly toward said circuit board and top connections facing upwardly away from said circuit board, at least some of said mounting connections being aligned with at least some of said contact pads, at least some of said top connections being unoccupied and available to receive one or more additional microelectronic elements.

10. A semi-finished circuit board assembly as claimed in claim 9 wherein said top connections are adapted for surface mounting of said one or more additional microelectronic elements to said top connections.

11. A semi-finished circuit board assembly as claimed in claim 9 wherein at least some of the top connections of said bottom unit overlie at least one said chip in said bottom unit.

12. A semi-finished circuit board assembly as claimed in claim 9 wherein said bottom unit includes a substrate incorporating a dielectric element having an upper surface facing upwardly away from said circuit board and a lower surface facing downwardly toward said circuit board, a plurality of mounting pads exposed at the lower surface of said dielectric element and a plurality of top connection pads exposed at the top surface, said at least one bottom unit chip being mounted beneath said lower surface, said mounting

connections including said mounting pads, said top connections including said top connection pads.

13. A semi-finished circuit board assembly as claimed in claim 12 further comprising masses of an electrically conductive bonding material extending between said mounting pads and said contact pads of said circuit board.

14. A semi-finished circuit board assembly as claimed in claim 9 wherein said bottom unit includes a dielectric substrate having a bottom region extending beneath the at least one bottom unit chip so that the bottom region of the substrate lies between the at least one bottom unit chip and the circuit board, said substrate having a top region extending over the at least one bottom unit chip, said top connections being disposed on the top region of the substrate.

15. A semi-finished circuit board assembly as claimed in claim 14 wherein said substrate has electrically conductive traces extending between said bottom and top regions, at least some of said bottom connections, said at least one bottom unit chip or both being electrically connected to at least some of said top connections through said traces.

16. A semi-finished circuit board assembly as claimed in claim 9 wherein said top connections include top conductive pads disposed in a pattern corresponding to an official standard for pads on a circuit board to receive a microelectronic element.

17. A multichip assembly comprising:

(a) a bottom unit including at least one bottom unit semiconductor chip, said bottom unit having downwardly-facing mounting pads and upwardly-facing top connection pads;

(b) mounting masses of a fusible electrically conductive bottom bonding material disposed in contact with said mounting pads;

(c) a first packaged semiconductor chip having terminals overlying at least some of said top connection pads; and

(d) a top conductive bonding material connecting at least some of said top connection pads and at least some of said terminals of said first packaged semiconductor chip,

said top conductive bonding material having lesser height than said mounting masses.

18. An assembly as claimed in claim 17 wherein said top conductive bonding material is provided in layers less than about 40 microns high and said mounting masses are at least about 100 microns high.

19. An assembly as claimed in claim 17 further comprising a circuit panel having a top surface and contact pads exposed at said top surface, said mounting masses being disposed between said mounting pads and said contact pads of said circuit panel.

20. An assembly as claimed in claim 17 wherein said bottom unit includes a substrate, at least a portion of said substrate extending above said bottom unit semiconductor chip, at least some of said top connection pads being disposed on said portion of said substrate.

21. An assembly as claimed in claim 20 wherein said substrate is generally planar and includes a central portion overlying said first bottom unit chip and at least one peripheral portion projecting outwardly beyond said first bottom chip, said mounting pads being disposed in said at least one peripheral portion, said mounting masses extending downwardly from said mounting pads.

22. An assembly as claimed in claim 20 wherein said substrate includes an upper portion extending above said first bottom unit chip and a lower portion extending beneath said first bottom unit chip, said top connection pads being disposed on said upper portion.

23. An assembly as claimed in claim 22 wherein said mounting masses extend at least partially through the lower portion of said substrate.

24. An assembly as claimed in claim 20 wherein said bottom unit chip is permanently mounted to said substrate.

25. An assembly as claimed in claim 20 wherein said first packaged chip includes a die, a package substrate extending beneath such die and terminals on said package substrate, said terminals on said package substrate being bonded to said top connection pads of said bottom unit.

26. An assembly as claimed in claim 19 wherein said first packaged chip is a chip-size packaged chip.

27. An assembly as claimed in claim 19 wherein said first packaged chip is a standard packaged chip.

28. An assembly comprising:

(a) a bottom unit including a first bottom unit semiconductor chip, a substrate having a portion extending over said bottom unit semiconductor chip, upwardly-facing top connection pads and downwardly-facing mounting pads on said substrate, at least some of said top connection pads being disposed in said portion of said substrate, said mounting pads being adapted for connection to contact pads on a circuit board, said bottom unit semiconductor chip being permanently connected to said substrate; and

(b) a first top microelectronic element at least partially overlying said portion of said substrate and said bottom unit chip, said top microelectronic element being removably mounted to said substrate and connected to said top connection pads.

29. An assembly as claimed in claim 28 wherein said at first top microelectronic element is a packaged semiconductor chip.

30. An assembly as claimed in claim 28 further comprising a top conductive bonding material electrically

connecting said top microelectronic element to said top connection pads, said first top microelectronic element being attached to said substrate only by said top conductive bonding material.

31. An assembly as claimed in claim 28 further comprising a top conductive bonding material electrically connecting said top microelectronic element to said top connection pads and attaching said first top microelectronic unit to said substrate at a joint therebetween, said joint being non-underfilled.

32. An assembly as claimed in claim 28 further comprising an encapsulant bonding said bottom unit semiconductor chip to the substrate.

33. An assembly as claimed in claim 28 wherein said bottom unit chip has a front surface with contacts thereon, a rear surface and edges extending between said front and rear surfaces, and wherein said bottom unit chip is mounted to said substrate with said rear surface facing toward said portion of said substrate and with said front surface facing away from said portion of said substrate.

34. An assembly as claimed in claim 28 wherein said bottom unit chip is wire-bonded to said substrate.

35. An assembly as claimed in claim 28 wherein said substrate has electrically-conductive traces thereon and said bottom unit chip is electrically connected to said traces by leads integral with said traces.

36. An assembly as claimed in claim 28 further comprising a circuit panel having contact pads thereon and masses of an electrically conductive bonding material extending between said mounting pads of said substrate and said contact pads of said circuit panel.

37. An assembly including:

(a) a bottom unit semiconductor chip having a front surface, a rear surface and edges extending between said surfaces;

(b) a substrate having a central portion extending above said bottom unit semiconductor chip, said bottom unit semiconductor chip being mounted to said central portion of said substrate with a surface of the chip facing upwardly toward the substrate, said substrate also having one or more peripheral portions projecting outwardly beyond the edges of the chip;

(c) first and second top microelectronic elements disposed above said substrate, at least one of said top microelectronic elements extending over said central portion and at least one of said top microelectronic elements extending over said peripheral portion; and

(d) mounting terminals on said substrate electrically connected to at least one of said chips and adapted for mounting said substrate to a circuit board.

38. An assembly as claimed in claim 37 wherein said bottom unit semiconductor chip has greater surface area than either of said first and second top microelectronic elements alone.

39. An assembly as claimed in claim 37 wherein said bottom unit semiconductor chip has a surface area less than the aggregate surface area of said first and second top microelectronic elements.

40. An assembly as claimed in claim 37 wherein said at least one peripheral portion includes first and second peripheral portions projecting beyond opposite edges of said bottom unit semiconductor chip, and wherein said first top microelectronic element overlies said first peripheral portion and part of said central portion and said second top

microelectronic element overlies said second peripheral portion and another part of said central portion.

41. An assembly as claimed in claim 40 wherein said mounting terminals include mounting pads disposed in said first and second peripheral portions.

42. An assembly as claimed in claim 41 wherein at said first and second top microelectronic elements overlie at least some of said mounting pads disposed in said first and second peripheral portions.

43. An assembly as claimed in claim 37 wherein said bottom unit semiconductor chip is permanently connected to said substrate and said top microelectronic elements are removably connected to said substrate.

44. An assembly as claimed in claim 37 wherein said first and second top microelectronic elements are packaged semiconductor chips.

45. An assembly as claimed in claim 37 further comprising a circuit panel having contact pads thereon and masses of an electrically conductive bonding material extending between said mounting pads of said substrate and said contact pads of said circuit panel.